



BROOKHAVEN
NATIONAL LABORATORY

NSRL-07C RUN

September - October 2007

FINAL REPORT

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<http://www.bnl.gov/medical/NASA>

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EXECUTIVE SUMMARY

During the fall of 2007, a series of radiobiological and physics experiments were performed using the proton and heavy ion beams available at the NASA Space Radiation Laboratory (NSRL). These experiments were part of the fourteenth NSRL scientific run (NSRL-07C) sponsored by NASA's Space Radiation Health Program (SRHP) heavy ion radiobiology research program at BNL.

A total of forty-one proposals were approved for participation in the NSRL-07C run in which one did not participate. One hundred and sixty seven users from thirty-two institutions were represented, all from the United States. There was no foreign representation this run. More than 4600 biological samples were exposed at the NSRL beam line, employing 263:03 hours of beam time (72:41 hours for in vivo studies, 148:20 hours for in vitro studies, and 42:02 hours for physics experiments) delivered in a six week period. In addition, 24:36 hours were used for dosimetry and beam development. Machine set-up took a total of 108:51 hours, and 20:30 hours for wrap-up of the beam. Accelerator problems with the NSRL beam accounted for 62:47 hours lost. This gave a total NSRL usage time of 479:47 hours. Since we were not running concurrently with RHIC, there was no time lost while due to RHIC. As a byproduct of this, all accelerator down-time counted towards the NSRL total.

During NSRL-07C, Booster provided protons (100, 150, 200, 250, 500, and 1000 MeV), oxygen (300 and 1000 MeV/n), silicon (300, 600, and 1000 MeV/n), iron (150, 300, 600, and 1000 MeV/n) and sequential fields of protons and iron (1000 MeV/n) beams for biology and physics experiments. Experimenters are becoming more interested in studying the effects of low doses and low dose rates. For this reason, our attention has been on developing stable low fluence beams with the same dosimetry capability of the higher intensity beam. The maximum dose rates used for biology experiments were as high as 7.5 Gray/min (Fe 1000 MeV/n). The general spill rate employed was 15 spills per minute with durations of 300 msec/spill. The spill fluence range was (particles/spill) from 1.5×10^{11} (max) and 2×10^2 (min). Square beam spots as big as $20 \times 20 \text{ cm}^2$ and as small as $1 \times 1 \text{ cm}^2$ were employed for biology and physics experiments.

Tandem-Booster set-up started on 31 August 2007 with the transport and circulation of Silicon beams at the NSRL complex. Beam was tuned into the target cave on 5 September 2007 and 300 MeV/n Si beams were available for tuning at 7:00 AM 5 September 2007. NSRL-07C officially ended at 1:58 PM 26 October 2007.

Projects Reviewed by the BNL Scientific Advisory Committee in Radiobiology

Proposal	PI	Sponsor	NSRL-07C Participation
B-7	RABIN, BERNARD	NASA	Yes
B-10	CHANG, POLLY	NASA	Yes
B-52	SUTHERLAND/GEWIRTZ...	NSBRI	Yes
N-88	SUTHERLAND, BETSY	NASA	Yes
N-89	HELD, KATHY	NASA	Yes
N-90	BAILEY, SUSAN	NASA	Yes
N-97	KRONENBERG, AMY	NASA	Yes
N-102	HALL, ERIC	NASA	Yes
N-103	BARCELLOS-HOFF, MARY HELEN	NASA-NSCOR	Yes
N-104	ULLRICH, ROBERT	NASA	Yes
N-108	OBENAU, ANDRE	NASA	Yes
N-129	LIMOLI, CHARLES	NASA	Yes
N-134	CHEN, DAVID	NASA	Yes
N-146	WU, HONGLU	NASA	Yes
N-153	MINNA, JOHN	NASA-DOE	Yes
N-154	MAURER, RICHARD HORNSBY	NASA/NSBRI	Yes
N-155	RABER, JACOB	NASA	Yes
N-157	SCHIESTL, ROBERT	NASA	Yes
N-159	HALL, ERIC	NASA	Yes
N-160	SPENCE, HARLAN	NASA-ESMD	Yes
N-163	WIESE, CLAUDIA	NASA	Yes
N-167	BURMA, SANDEEP	NASA	Yes
N-171	DYNLACHT, JOSEPH	NASA	Yes
N-172	BERKOWITZ, DAN	NASA	Yes
N-175	FIKE, JEFFREY	DOE NASA-NSCOR	Yes
N-177	MORGAN	NASA	No
N-180	CARSON, WILLIAM	NASA	Yes
N-181	OBENAU, ANDRE	NASA	Yes
N-185	SUTHERLAND, BETSY	NASA-DOE	Yes
N-186	SHAY, JERRY	NASA	Yes
N-187	REDPATH, JOHN	NASA	Yes
N-188	GREENLORA	NASA	Yes
N-190	IANZINI, FIORENZA	NASA	Yes
N-193	O'BANION, MICHAEL	NASA-DOE	Yes

Proposal	PI	Sponsor	NSRL-07C Participation
N-194	KUCIK, DENNIS	NASA	Yes
N-196	AZZAM, EDOUARD	NASA	Yes
N-197	FORNACE, AL	NASA	Yes
N-198	GLOBUS, RUTH	NASA	Yes
N-200	HLATKY, LYNN	NASA	Yes
N-203	BRITTEN, RICHARD	NASA	Yes
N-204	AMUNDSON, SALLY	NASA-DOE	Yes
N-205	KLEIMAN, NORMAN	NASA-DOE	Yes

†Not Present During Actual Run

PARTICIPANTS (Principal Investigators are highlighted)

Exp.	Name	Guest Title	Employer
B-7	Rabin, Bernard Carrihill, Kirsty Lee Cheng, Vivian Shukitt-Hale, Barbara	Ph.D, Principal Investigator Guest Research Associate Guest Jr Research Associate Guest Scientist	University of Maryland University of Maryland University of Maryland Tufts University
B-10	Chang, Polly Yee Bakke, James Hutson, Christopher	Ph.D, Principal Investigator Guest Scientific Associate Guest Jr Research Associate	SRI International SRI International SRI International
B-52	SUTHERLAND/GEWIRTZ BENNETT NAIDU J. SUTHERLAND MONTELEONE TRUNK	Ph.D, Principal Investigators M.S., Co-Worker PhD., Co-Worker PhD., Co-Worker B.S., Co-Worker PhD., Co-Worker	BNL, Biology Dept./Univ. of Pennsylvania BNL, Biology Dept., Upton, NY BNL, Biology Dept., Upton, NY BNL, Biology Dept., Upton, NY BNL, Biology Dept., Upton, NY BNL, Biology Dept., Upton, NY
N-88	Sutherland, Betsy Vercoutere, Wenonah A.	Ph.D, Principal Investigator Guest Scientist	BNL, Biology Dept. National Aeronautics and Space Admin. (NASA)
N-89	Held, Kathryn Han, Wei Kumaraswamy, Deepak Magpayo, Nicole Yang, Hongying	Ph.D, Principal Investigator Guest Jr Research Associate Guest Scientific Associate Guest Scientific Associate Guest Scientist	Massachusetts General Hospital Massachusetts General Hospital Massachusetts General Hospital Massachusetts General Hospital Massachusetts General Hospital
N-90	Bailey, Susan	Ph.D, Principal Investigator	Colorado State University
N-97	Kronenberg, Amy Gauny, Stacey Kwoh, Ely	Ph.D, Principal Investigator Guest Scientific Associate Guest Scientific Associate	Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory
N-102	Hall, Eric J David, Janice Maerki, Jennifer Meador, Jarah	Ph.D, Principal Investigator Guest Scientific Associate Guest Research Assistant Guest Research Associate	Columbia University Columbia University Columbia University Columbia University

Exp.	Name	Guest Title	Employer
	Smilenov, Lubomir B.	Guest Scientist	Columbia University, Nevis Laboratories
N-103	Barcellos-Hoff, Mary Helen Costes, Sylvain Vincent Deheuninck, Julien Groesser, Torsten Kronenberg, Amy Mukhopadhyay, Rituparna Rydberg, Bjorn E.	Ph.D, Principal Investigator Guest Scientist Guest Research Associate Guest Research Associate Guest Scientist Guest Research Associate Guest Scientist	Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory
N-104	Weil, Michael Fallgren, Christina Marie Genik, Paula Constance Peng, Yuanlin Ray, Frank Andrew	Ph.D, Principal Investigator Guest Scientific Associate Guest Scientist Guest Scientist Guest Scientist	Colorado State University Colorado State University Colorado State University Colorado State University Colorado State University
N-108	Obenaus, Andre Jones, Tamako	Ph.D, Principal Investigator Guest Scientific Associate	NASA - Loma Linda University Medical School NASA - Loma Linda University Medical School
N-187	Redpath, John Leslie Elmore, Eugene Lawrence	Ph.D, Principal Investigator Guest Scientist	University of California @ Irvine University of California @ Irvine
N-129	Limoli, Charles Giedzinski, Erich Suarez, Vannina	Ph.D, Principal Investigator Guest Scientific Associate Guest Scientific Associate	University of California @ Irvine University of California @ Irvine University of California @ Irvine
N-134	Chen, David Aroumougame, Asaithamby Gonzalez, Oscar Ruben	Ph.D, Principal Investigator Guest Scientist Guest Research Assistant	University of Texas Southwestern University of Texas Southwestern University of Texas Southwestern
N-145	O'Banion, Michael Hurley, Sean David Trojanczyk, Lee Ann Williams, Jacqueline Patricia	Ph.D, Principal Investigator Guest Scientist Guest Scientific Associate Guest Scientist	University of Rochester University of Rochester University of Rochester University of Rochester
N-146	Wu, Honglu Meador, Jarah	Ph.D, Principal Investigator Guest Research Associate	NASA - Johnson Space Center Columbia University
N-153	Story, Michael/Minna	Ph.D, Principal Investigator	University of Texas Southwestern

Exp.	Name	Guest Title	Employer
	Delgado, Oliver Park, Seongmi Peyton, Michael Jess	Guest Jr Research Associate Guest Research Associate Guest Scientist	University of Texas Southwestern University of Texas Southwestern University of Texas Southwestern
N-154	Maurer, Richard Hornsby Goldsten, John Grey, Matthew Roth, David Richard Zeitlin, Cary	Ph.D, Principal Investigator Guest Research Assistant Guest Research Assistant Guest Scientist Guest Scientist	Johns Hopkins University Johns Hopkins University Johns Hopkins University Johns Hopkins University Lawrence Berkeley National Laboratory
N-155	Raber, Jacob Villasana, Laura	Ph.D, Principal Investigator Guest Jr Research Associate	Oregon Health & Science University Oregon Health & Science University
N-157	Schiestl, Robert Hacke, Katrin Hafer, Kurt Yamamoto, Mitsuko Lynn	Ph.D, Principal Investigator Guest Research Associate Guest Jr Research Associate Guest Jr Research Associate	University of California @ Los Angeles University of California @ Los Angeles University of California @ Los Angeles University of California @ Los Angeles
N-159	Hall, Eric J Maerki, Jennifer Meador, Jarah Smilenov, Lubomir B. David, Janice	Ph.D, Principal Investigator Guest Research Assistant Guest Research Associate Guest Scientist Guest Scientific Associate	Columbia University Columbia University Columbia University Columbia University, Nevis Laboratories Columbia University
N-160	Spence, Harlan E. Foster, Richard F Golightly, Michael Joseph Larsen, Brian	Ph.D, Principal Investigator Guest Scientific Associate Guest Scientific Associate Guest Scientist	Boston University Massachusetts Institute of Technology Boston University Boston University
N-163	Wiese, Claudia Zafar, Faria	Ph.D, Principal Investigator Guest Jr Research Associate	Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory
N-167	Burma, Sandeep McEllin, Brian	Ph.D, Principal Investigator Guest Jr Research Associate	University of Texas Southwestern University of Texas Southwestern
N-171	Dynlacht, Joseph Caperell-Grant, Andrea Garrett, Joy	Ph.D, Principal Investigator Guest Scientific Associate Guest Research Assistant	Indiana University @ Indianapolis Indiana University @ Indianapolis Indiana University @ Indianapolis

Exp.	Name	Guest Title	Employer
N-172	Berkowitz, Dan Bugaj, Lukasz Soucy, Kevin Gilbert	Ph.D, Principal Investigator Guest Jr Research Associate Guest Jr Research Associate	Johns Hopkins University Johns Hopkins University Johns Hopkins University
N-175	Fike, Jeffrey Smith, Anna Lucille	Ph.D, Principal Investigator Guest Scientific Associate	Loma Linda University Loma Linda University
N-180	Carson, William Dungan, Larry Kenneth Klyachko, Alexander Rojdev, Kristina Wheeler, Scott	Ph.D, Principal Investigator Guest Scientific Associate Guest Scientist Guest Scientific Associate Guest Scientific Associate	NASA - Johnson Space Center NASA - Johnson Space Center Indiana University @ Bloomington NASA - Johnson Space Center NASA - Johnson Space Center
N-181	Obenaus, Andre Smith, Anna Lucille Jones, Tamako	Ph.D, Principal Investigator Guest Scientific Associate Guest Scientific Associate	Loma Linda University Loma Linda University NASA - Loma Linda University Medical School
N-185	Sutherland, Betsy	Ph.D, Principal Investigator	BNL, Biology Dept.
N-186	Shay, Jerry Roig, Andres	Ph.D, Principal Investigator Guest Jr Research Associate	University of Texas Southwestern University of Texas Southwestern
N-187	Redpath, John Elmore, Eugene	Guest Scientist Guest Scientist	University of California @ Irvine University of California @ Irvine
N-188	Green, Lora Murray Bianski, Brandon Sanchez, Martha Celia	Ph.D, Principal Investigator Guest Scientific Associate Guest Research Assistant	Loma Linda University Medical Center Loma Linda University Loma Linda University
N-190	Ianzini, Fiorenza Kosmacek, Elizabeth Anne	Ph.D, Principal Investigator Guest Research Assistant	University of Iowa University of Iowa
N-193	O'Banion, Kerry	Ph.D, Principal Investigator	University of Rochester
N-194	Kucik, Dennis F Gupta, Kiran B Khaled, Saman Fatima Yu, Tao	Ph.D, Principal Investigator Guest Jr Research Associate Guest Jr Research Associate Guest Jr Research Associate	University of Alabama University of Alabama University of Alabama University of Alabama
N-196	Azzam, Edouard Iskandar Autsavapromporn, Narongchai	Ph.D, Principal Investigator Guest Jr Research Associate	University of Medicine and Dentistry of NJ University of Medicine and Dentistry of NJ

Exp.	Name	Guest Title	Employer
	Buonanno, Manuela de Toledo, Sonia Maria Yang, Zhi	Guest Research Assistant Guest Scientist Guest Research Associate	University of Medicine and Dentistry of NJ University of Medicine and Dentistry of NJ University of Medicine and Dentistry of NJ
N-197	Fornace, Jr, Albert Datta, Kamal Doiron, Kathryn E Li, Henghong	Ph.D, Principal Investigator Guest Research Associate Guest Scientific Associate Guest Scientist	Georgetown University Georgetown University Georgetown University Georgetown University
N-198	Globus, Ruth Mojarrab, Rose Searby, Nancy Vercoutere, Wenonah A. Yumoto, Kenji	Ph.D, Principal Investigator Guest Scientific Associate Guest Scientist Guest Scientist Guest Jr Research Associate	NASA - Ames Research Center NASA - Ames Research Center NASA Headquarters National Aeronautics and Space Admin. (NASA) NASA - Ames Research Center
N-200	Hlatky, Lynn Beheshti, Afshin Enderling, Heiko Girdhani, Swati Hahnfeldt, Philip Lamont, Clare	Ph.D, Principal Investigator Guest Scientist Guest Scientist Guest Scientist Guest Scientist Guest Scientific Associate	Tufts University Tufts University Tufts University Tufts University Tufts University Tufts University
N-203	Britten, Richard Johnson, Angela Mitchell, Shamina Singletary, Sylvia J	Ph.D, Principal Investigator Guest Scientific Associate Guest Jr Research Associate Guest Scientist	Eastern Virginia Medical School Eastern Virginia Medical School Eastern Virginia Medical School Eastern Virginia Medical School
N-204	Amundson, Sally A. Mezentsev, Alexandre	Ph.D, Principal Investigator Guest Scientist	Columbia University Columbia University
N-205	Kleiman, Norman	Ph.D, Principal Investigator	Columbia University
NSRL(NASA)	Sulzman, Frank Michael	Guest Scientist	NASA – Johnson Space Center
NSRL	Guida Peter ‡	Scientist	Scientist
NSRL	Tafrov, Stefan ‡	Associate Scientist	Associate Scientist
NSRL	Keszenman, Deborah ‡	Associate Scientist	Associate Scientist
NSRL	Pyatt, Beatrice ‡	Medical Associate	Medical Associate

Exp.	Name	Guest Title	Employer
NSRL	Abele, William ‡	Associate Scientist	Brookhaven National Laboratory
NSRL	Sutherland, John ‡	Senior Scientist	Brookhaven National Laboratory
NSRL	Bennett, Paula ‡	Biology Associate I	Brookhaven National Laboratory
NSRL	Trunk, John ‡	Senior Technical Associate	Brookhaven National Laboratory
NSRL	Hein, Patricia ‡	Senior Administrative Assistant	Brookhaven National Laboratory
NSRL	Kershaw, Maryann ‡	BLAF Manager	Brookhaven National Laboratory
NSRL	Jardine, James ‡	Laboratory Specialist	Brookhaven National Laboratory
NSRL	Sivertz, Michael ‡	Scientist	Brookhaven National Laboratory
NSRL	Naidu, Mamta ‡	Associate Scientist	Brookhaven National Laboratory
NSRL	Kim, Angela ‡	Medical Associate	Brookhaven National Laboratory
NSRL	Billups, Adele ‡	Medical Associate	Brookhaven National Laboratory
NSRL	Thompson, Laura ‡	Medical Associate	Brookhaven National Laboratory
NSRL	Forrette, Elise ‡	Administrative Assistant	Brookhaven National Laboratory
NSRL	Bonti, Kerry ‡	BLAF Staff	Brookhaven National Laboratory
NSRL	Snyder, Deborah ‡	BLAF Staff	Brookhaven National Laboratory
NSRL	Reiszel, Corrine ‡	BLAF Staff	Brookhaven National Laboratory
NSRL	Rusek, Adam ‡ ‡	Scientist	Brookhaven National Laboratory

† Not present during actual run.

‡ BNL Personnel who participated in many different experiments throughout the run.

PARTICIPANT INSTITUTIONS

Universities (22)

Boston University
Colorado State University
Columbia University
Columbia University, Nevis Laboratories
Eastern Virginia Medical School
Georgetown University
Indiana University @ Bloomington
Indiana University @ Indianapolis
Johns Hopkins University
Loma Linda University
Loma Linda University Medical Center
Oregon Health & Science University
Massachusetts Institute of Technology
Tufts University
University of Alabama
University of California @ Irvine
University of California @ Los Angeles
University of Iowa
University of Maryland
University of Medicine and Dentistry of NJ
University of Rochester
University of Texas Southwestern

National Laboratories/Institutions (2)

Brookhaven National Laboratory
Lawrence Berkeley National Laboratory

NASA Related Centers/institutions (5)

NASA - Ames Research Center
NASA - Johnson Space Center
NASA - Loma Linda University Medical School
National Aeronautics and Space Admin. (NASA)
NASA Headquarters

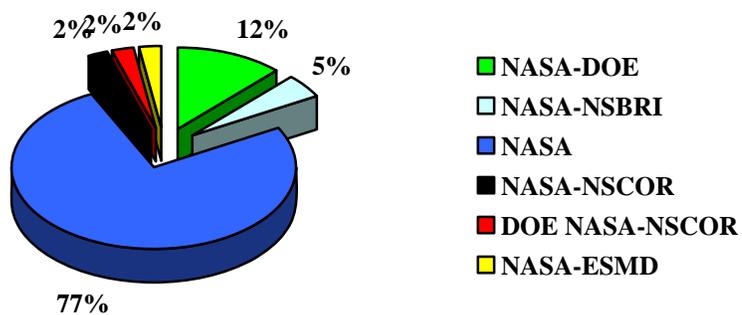
Private Institutions(1)

Massachusetts General Hospital

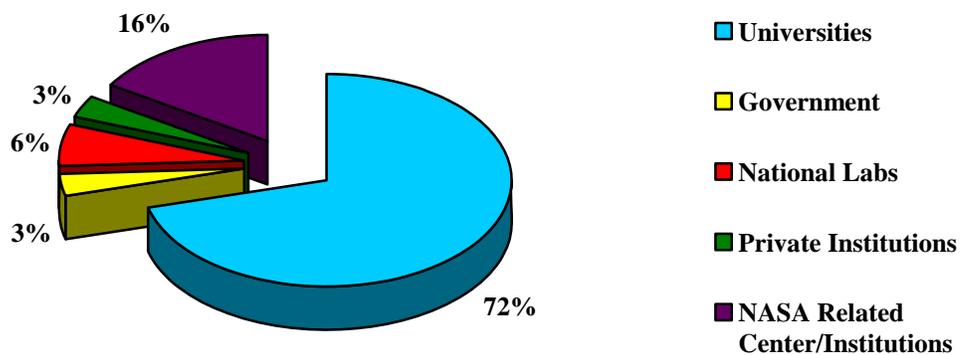
Government (1)

SRI International

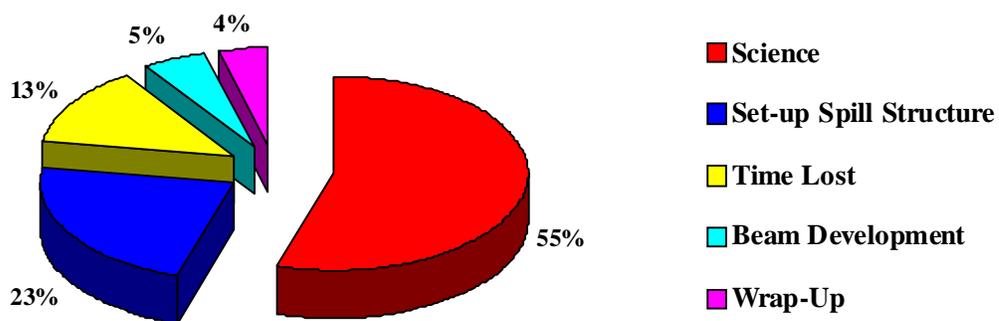
RESEARCH PROJECT SPONSORS



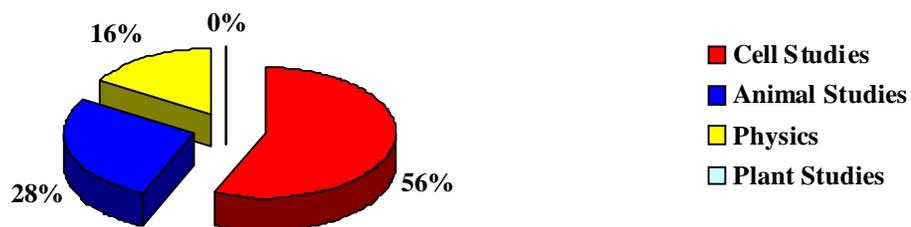
INSTITUTION STATISTICS



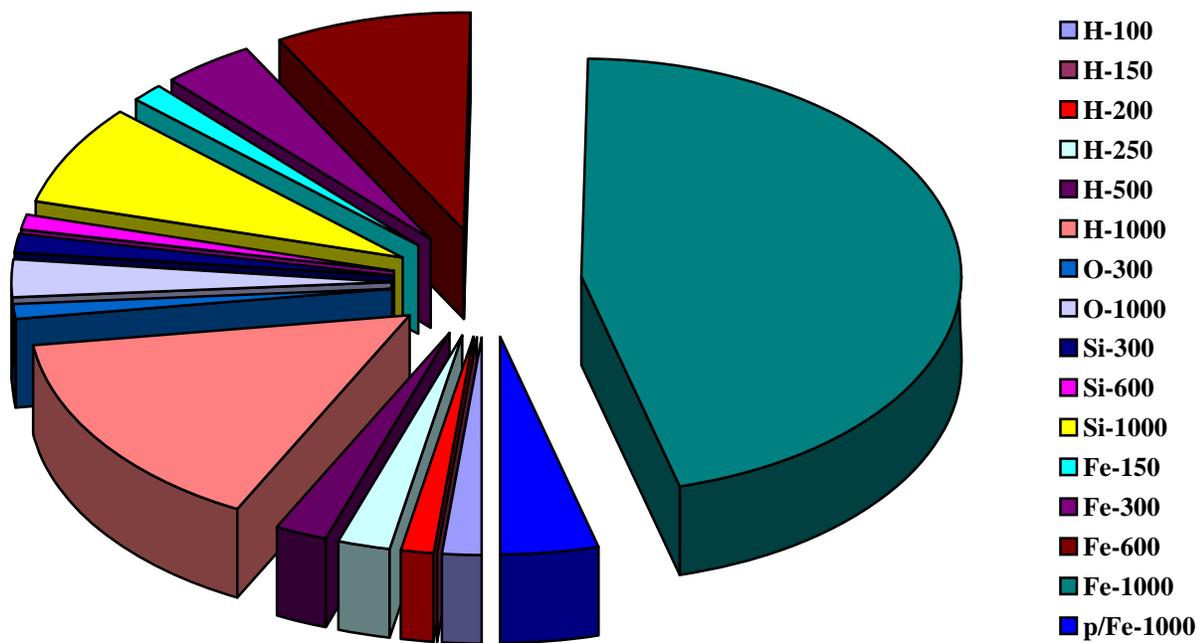
TOTAL RUN-TIME STATISTICS



SCIENCE STUDIES STATISTICS



ION SPECIES AND ENERGY (MeV/n) DISTRIBUTION



RUN TIME DESCRIPTION (hours)

NSRL-07C	ION SPECIES AND ENERGIES (MeV/nucleon)										
	H						O		Si		
	100	150	200	250	500	1000	300	1000	300	600	1000
Machine Set-Up	2:00:00	2:00:00	2:00:00	2:00:00	2:00:00	16:00:00	2:00:00	4:00:00	2:00:00	2:00:00	4:00:00
Wrap-Up	0:00:00	0:30:00	0:30:00	0:00:00	1:00:00	2:30:00	0:00:00	1:00:00	0:00:00	0:00:00	1:30:00
Development	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00
Science											
In Vitro	1:29:58	0:00:00	0:00:00	7:59:57	6:26:45	30:59:48	1:24:08	3:20:43	1:14:38	2:48:50	2:29:16
In Vivo	0:00:00	5:58:29	3:34:34	0:00:00	0:00:00	6:57:48	0:00:00	3:14:33	0:00:00	0:00:00	0:00:00
Others	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00
Physics	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	22:12:34
NSRL Time Lost	4:15:00	1:45:00	0:00:00	0:30:00	1:25:00	15:30:00	2:00:00	1:25:00	3:00:00	0:00:00	4:55:00
Totals	7:45	10:13	6:05	10:30	10:52	71:58	5:24	13:00	6:15	4:49	35:07

(continued next page)

NSRL-07C	ION SPECIES AND ENERGIES (MeV/nucleon)					Total
	p/Fe	Fe				
	1000	150	300	600	1000	
Machine Set-Up	4:00:00	4:00:00	6:00:00	8:00:00	46:51:00	108:51
Wrap-Up	0:30:00	0:00:00	0:30:00	2:30:00	10:00:00	20:30
Non-Science Sub-Total:						129:21
Development	0:00:00	0:00:00	2:35:00	0:00:00	22:00:45	24:36
Science						
In Vitro	10:19:00	3:00:00	4:06:49	1:28:00	71:11:42	148:20
In Vivo	0:00:00	0:00:00	3:15:51	22:20:27	27:19:43	72:41
Others	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00
Physics	0:00:00	0:00:00	0:00:00	0:00:00	19:49:19	42:02
Science Sub Total:						263:03
NSRL Time Lost	4:45:00	0:00:00	2:12:00	4:40:00	16:25:00	62:47
Totals	19:34	7:00	18:40	38:58	213:37	479:47

BEAM CHARACTERISTICS

Ion	H						O	
Energy (MeV/n)								
Planned	100	150	200	250	500	1000	300	1000
Extracted	103.1	150	200	250	500	1000	300	1000
On Target	103.1	150*	200*	250*	500*	1000*	300*	1000*
Fluence (particles/cm²/sec)								
Maximum on target	8.3E+5	1.3E+7	3.5E+7	9.1E+6	4.3E+7	4.3E+7	1.6E+5	5.0E+5
Minimum on target	4.1E+5	0.4E+7	0.9E+6	2.2E+5	200	200	0.5E+6	0.6E+4
Spill Period (sec)	4	4	4	4	4	4	4	4
Spill rate (spills/min)	15	15	15	15	15	15	15	15
Spill length (msec)	300	300	300	300	300	300	300	300
Particles/spill								
Maximum	3.3E+6	5.2E+7	1.4E+8	3.6E+7	1.7E+8	1.7E+8	6.3E+5	2.0E+6
Minimum	200	200	0.3E+8	1.0E+6	8.0E+5	8.0E+5	2.1E+5	0.3E+5
Beam Cut Off Accuracy	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
Actual LET on Target (keV/μm)	0.715	0.546*	0.405*	0.392*	0.275*	0.222*	22.6*	14.2*
Max. Dose Rate (Gy/min)								
20 cm x 20 cm	0.05	0.6	1.2	0.3	1	0.8	0.3	0.6
Total Dose (Gy)								
Maximum	0.2	3	2	4	50	8	3	3
Minimum	0.1	1	0.5	0.1	0.00001	0.00001	1	0.05

* No Bragg results are available for H running at 500 or 1000 MeV, or Fe at 300 MeV/nucleon. Only calculated LET is quoted.

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Ion	Si			p/FeH	Fe			
Energy (MeV/n)								
Planned	300	600	1000	1000	150	300	600	1000
Extracted	300	600	1000	1000	151.1	296.8	591.5	964.9
On Target	308.9	591.9	1000*	1000*	151.1	296.8	591.5	964.9
Fluence (particles/cm²/sec)								
Maximum on target	6.8E+5	3.1E+5	2.7E+6	N/A	6.4E+4	5.0E+4	1.4E+5	3.1E+5
Minimum on target	6.8E+3	3.1E+3	0.7E+4	N/A	6.4E+4	200	1.6E+3	200
Spill Period (sec)	4	4	4	4	4	4	4	4
Spill rate (spills/min)	15	15	15	15	15	15	15	15
Spill length (msec)	300	300	300	300	300	300	300	300
Particles/spill								
Maximum	2.7E+6	1.2E+6	1.1E+7	N/A	2.6E+5	2.0E+5	5.4E+5	1.3E+6
Minimum	2.7E+4	1.2E+4	0.3E+5	N/A	2.6E+5	200	6.0E+3	8.0E+5
Beam Cut Off Accuracy	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
Actual LET on Target (keV/μm)	69.3	50.3	43.6	0.222*/151	368	239*	174	151
Max. Dose Rate (Gy/min)								
20 cm x 20 cm	4	1.3	10	0.2	2	1	2	4
Total Dose (Gy)								
Maximum	50	50	100	1.5	1	1	4	7.5
Minimum	0.5	0.5	0.25	0.00001	1	0.00001	0.05	0.00001

* No Bragg results are available for H running at 500 or 1000 MeV, or Fe at 300 MeV/nucleon. Only calculated LET is quoted.

DOSIMETRY AND BEAM DEVELOPMENTS

New Beams:

During NSRL 07C the flowing beams were developed and used for the first time:

Protons at 100, and 150 MeV,

Oxygen at 300 MeV/n and

Iron at 150 MeV/n.

RUN DATES

Ion	Energy	Scheduled Start	Scheduled End	Actual Start	Actual End
Silicon	300-1000	9/05/07 7:00	9/05/07 17:30	9/05/07 7:00	9/05/07 17:17
Oxygen	300-1000	9/08/07 7:00	9/10/07 19:00	9/08/07 7:00	9/10/07 14:59
Iron	150-1000	9/11/07 7:00	9/21/07 16:00	9/11/07 5:15	9/21/07 12:20
p/Fe	1000	9/24/07 7:00	9/26/07 20:00	9/24/07 7:00	9/26/07 20:34
Iron	150-1000	9/27/07 7:00	10/01/07 20:00	9/27/07 7:00	10/01/07 19:02
Protons	100-1000	10/02/07 7:00	10/02/07 21:30	10/02/07 7:00	10/02/07 20:37
Iron	150-1000	10/03/07 7:00	10/03/07 16:00	10/03/07 7:00	10/03/07 15:45
Protons	100-1000	10/4/07 7:00	10/04/07 20:30	10/04/07 7:00	10/04/07 18:28
Iron	150-1000	10/05/07 7:00	10/05/07 17:00	10/05/07 7:00	10/05/07 15:00
Protons	100-1000	10/06/07 7:00	10/12/07 19:30	10/06/07 7:00	10/12/07 15:38
Iron	150-1000	10/15/07 7:00	10/26/07 18:30	10/15/07 7:00	10/26/07 14:28

EXPERIMENTERS AND RUN STATISTICS

Proposal	Principle Investigator	Ion	Energy	Beam Time Approved	Beam Time Used	Dose Rate	Dose Range	Number of Samples
B-7	Rabin, Bernard	Iron	600	6:30	4:59:25	10-200	10-350	65
B-7	Rabin, Bernard	Oxygen	1000	5:00	4:39:33	60	5-200	80
B-10	Chang, Polly	Protons	1000	16:00	6:57:50	20-35	10-500	113
B-52	Gewirtz, Alan	p/Fe	1000	4:00	4:38:47	20	0-20	40
B-185	Sutherland,Betsy	Iron	1000	4:15	5:44:04	20	10-100	141
B-185	Sutherland,Betsy	Protons	1000	4:15	10:07:18	20	10-100	8
N-88	Sutherland, Betsy	Iron	300	2:00	0:42:00	20	10-30	6
N-88	Sutherland, Betsy	Iron	600	0:00	0:33:00	20	10-30	6
N-88	Sutherland, Betsy	Iron	1000	2:30	0:45:00	20	10-30	6
N-88	Sutherland,Betsy	Protons	100	1:30	1:29:58	5	10-20	4
N-88	Sutherland,Betsy	Protons	250	2:00	3:49:14	20	10-30	12
N-88	Sutherland,Betsy	Protons	500	2:30	3:19:27	.000001-20	10-30	14
N-88	Sutherland,Betsy	Protons	1000	2:00	1:52:59	20	10-30	12
N-88	Sutherland, Betsy	Silicon	600	2:00	2:48:50	20	20	12
N-89	Held, Kathy	Iron	1000	7:00	5:17:57	.00001-200		1
N-89	Held, Kathy	p/Fe	1000	6:24	6:25:13	1	150	1
N-89	Held, Kathy	Protons	1000	6:12	7:00:00	.000001-20	.0000001 - 20	606
N-90	Bailey, Susan	Iron	1000	2:00	0:42:20	100	100-200	16
N-97	Kronenberg, Amy	Iron	1000	9:00	7:07:33	100	50-300	24
N-97	Kronenberg, Amy	Protons	1000	9:00	10:57:30	80	50-530	48
N-102	Hall, Eric	Iron	1000	4:24	0:44:49	100	20-300	24
N-103	Barcellos-Hoff, Mary Helen	Iron	150	3:00	3:00:00	100-200	100	21
N-103	Barcellos-Hoff, Mary Helen	Iron	1000	9:00	9:39:17	10-100	10-200	180
N-104	Weil, Michael	Protons	150	5:30	7:43:31	60	100-300	224
N-108	Obenaus, Andre	Iron	600	3:00	6:05:32	100	100-400	160
N-129	Limoli, Charles	Iron	1000	7:00	6:36:46	20-200	10-750	113
N-134	Chen, David	Oxygen	1000	1:00	2:07:24	50-60	100	32
N-134	Chen, David	Silicon	300	1:00	4:14:38	100	100	10
N-134	Chen, David	Silicon	1000	1:00	0:48:46	100	100	32

Proposal	Principle Investigator	Ion	Energy	Beam Time Approved	Beam Time Used	Dose Rate	Dose Range	Number of Samples
N-146	Wu, Honglu	Iron	600	3:00	0:55:00	90	25-100	7
N-153	Story, Michael	Iron	300	3:00	3:45:59	100	20-100	76
N-153	Story, Michael	Iron	1000	10:00	10:41:12	20-100	20-100	269
N-153	Story, Michael	Oxygen	300	3:00	3:24:08	30	100-300	18
N-153	Story, Michael	Oxygen	1000	0:30	1:13:19	30	100-300	18
N-153	Story, Michael	Silicon	1000	1:00	1:40:30	100	25-100	40
N-154	Maurer, Richard	Iron	1000	8:00	8:32:25	.000001	.000001	1
N-154	Maurer, Richard	Silicon	1000	16:00	17:29:58	.000001	.000001	3
N-157	Schiestl, Robert	Iron	1000	3:00	2:29:16	100	100-200	123
N-159	Hall, Eric	Iron	600	11:00	2:21:02	50	25	40
N-160	Spence, Harlan	Iron	1000	4:42	5:26:36	low	low	1
N-160	Spence, Harlan	Silicon	1000	4:42	4:42:36	low	low	1
N-163	Wiese, Claudia	Iron	1000	7:00	4:08:42	50-200	25-300	115
N-167	Burma, Sandeep	Iron	1000	2:00	1:19:36	100-400	100-400	1
N-171	Dynlacht, Joseph	Iron	600	5:48	4:52:02	15-100	100-400	123
N-172	Berkowitz, Dan	Iron	1000	2:30	1:40:00	50	100	22
N-180	Carson, William	Iron	1000	18:00	5:50:18	low		1
N-186	Shay, Jerry	Iron	1000	2:00	0:33:24	100	50-150	12
N-186	Shay, Jerry	Protons	1000	2:00	1:27:42	20	100-300	16
N-187	Redpath, Les	Iron	1000	1:00	1:46:44	20	20	40
N-187	Redpath, Les	Protons	1000	1:00	1:05:38	20	20	48
N-188	Green, Lora	Iron	1000	9:00	7:47:05	50-200	10-200	130
N-190	Ianzini, Fiorenza	Iron	1000	15:00	5:13:25	80-100	50-200	160
N-193	Obanion, M. Kerry	Iron	1000	9:45	5:51:46	3-100	1-600	256
N-194	Kucik, Dennis	Protons	200	1:00	3:34:34	120	50-200	40
N-194	Kucik, Dennis	Protons	250	1:00	4:10:43	30	100-400	100
N-196	Azzam, Edouard	Iron	1000	7:12	7:59:51	100	10-200	84
N-197	Fornace, Al	Iron	1000	3:18	3:41:15	100	60-700	66
N-197	Fornace, Al	Protons	1000	3:18	3:23:45	20	100-800	28
N-198	Globus, Ruth	Iron	1000	7:00	3:02:28	10-200	10-750	97
N-200	Hlatky, Lynn	Iron	1000	12:30	12:00:35	10-100	10-100	378
N-200	Hlatky, Lynn	Protons	1000	3:24	3:42:12	30	100-400	140

Proposal	Principle Investigator	Ion	Energy	Beam Time Approved	Beam Time Used	Dose Rate	Dose Range	Number of Samples
N-203	Britten, Richard	Iron	1000	2:00	3:03:20	100	130-300	76
N-204	Amudson, Sally	Iron	300	3:00	2:54:41	0.000001	0.0000001	16
N-205	Kleiman, Norman	Iron	600	4:00	4:42:26	100	50	85

Total approved hours of science (not including those proposals that chose not to run in 07C is 319:39.

Total number of hours of science that ran in Run 07C is 263:03.